

according to some embodiments. FIG. 27 shows that there are optimal or ideal focus curves for each foveal eye box point 2622. However, in some embodiments, a beam focusing element 2630 (e.g., implemented as an optical lens or alternatively as holograms for each color) may be used to focus beams from foveal projection points at a focus curve 2640 that is a 'best fit' of the family of ideal focus curves for the different foveal eye box points. In some embodiments, the focus curve 2640 may be "best fit" to provide optimal resolution and less error at the middle of the FOV. The best fit focus curve 2640 forms the ideal image plane for a notional lens. Beam focusing element 2630 focuses the light at best fit focus curve 2640 as the light is scanned across an angle. Note that the best fit curve is generally closer to the optical curves and errors between the best fit curve and the family of optical curves for foveal eye box points are smaller than those for peripheral eye box points because the field of each eye box is smaller and scan angles are smaller. However, errors are more significant for foveal projection as higher resolution is needed.

[0136] FIG. 28 illustrates projector scan angle for foveal projections, according to some embodiments. FIG. 29A is a graph of foveal projector resolution vs. pupil angle in an AR system, according to some embodiments. FIG. 29B is a graph of beam diameter for foveal projections in an AR system, according to some embodiments. As with the peripheral projector, it may be necessary to reduce the beam diameter at the edges of the scan for each foveal eye box point, for example from 2.3 mm at the center of the scan to a minimum 0.73 mm for a particular range of scan angles. The optimal resolution may require bands of different beam diameters across the projector scan range. In some embodiments, coatings on the foveal projectors may be used to achieve this adjustment of beam diameter with field angle. In some embodiments, the coatings may be part of a further layer laminated to the waveguide structure of the light engine.

[0137] As shown in FIG. 29B, in some embodiments, when scanning through the angles in foveal projection, there will be a "sawtooth" change in beam diameter. In peripheral projection, the beam diameter can be tailed off at higher angles; for foveal projection, instead, scanning goes through a series of steps, with a large (e.g., 7 mm) beam at the middle of each scan, but tailing off at bigger angles. As shown in FIG. 29A, foveal projection is thus constantly above actual eye resolution over the angles of interest, up to 10 degrees, and thus the desired resolution can be achieved.

[0138] The methods described herein may be implemented in software, hardware, or a combination thereof, in different embodiments. In addition, the order of the blocks of the methods may be changed, and various elements may be added, reordered, combined, omitted, modified, etc. Various modifications and changes may be made as would be obvious to a person skilled in the art having the benefit of this disclosure. The various embodiments described herein are meant to be illustrative and not limiting. Many variations, modifications, additions, and improvements are possible. Accordingly, plural instances may be provided for components described herein as a single instance. Boundaries between various components, operations and data stores are somewhat arbitrary, and particular operations are illustrated in the context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within the scope of claims that follow. Finally,

structures and functionality presented as discrete components in the example configurations may be implemented as a combined structure or component. These and other variations, modifications, additions, and improvements may fall within the scope of embodiments as defined in the claims that follow.

What is claimed is:

1. A system, comprising:
 - a controller;
 - a light engine configured to project light beams from a plurality of projection points under control of the controller;
 - a reflective holographic combiner comprising a plurality of point-to-point holograms configured to redirect light received from the plurality of projection points to a plurality of eye box points;
 - wherein each projection point projects light beams to two or more of the plurality of holograms, wherein the two or more holograms redirect the light beams to illuminate two or more respective eye box points; and
 - wherein the holograms are configured such that neighboring eye box points are illuminated by different ones of the holograms.
2. The system as recited in claim 1, wherein the plurality of eye box points includes foveal and peripheral eye box points, and wherein the plurality of projection points includes:
 - two or more foveal projectors configured to project wide diameter light beams over a small field of view, wherein foveal light beams are redirected to illuminate foveal eye box points; and
 - two or more peripheral projectors configured to project narrow diameter light beams over a wide field of view, wherein peripheral light beams are redirected to illuminate peripheral eye box points.
3. The system as recited in claim 2, wherein the diameter of the foveal light beams is 4 mm or greater when exiting the foveal projectors.
4. The system as recited in claim 2, wherein the diameter of the foveal light beams is 2.3 mm or less at the foveal eye box points, and wherein the diameter of the peripheral light beams is 0.5 mm or less at the peripheral eye box points.
5. The system as recited in claim 2, wherein field of view of the foveal light beams is 20° horizontal×20° vertical, and wherein field of view of the peripheral light beams is 120° horizontal×74° vertical.
6. The system as recited in claim 2, wherein the light engine includes a plurality of light sources, and wherein the controller is configured to selectively activate and modulate particular ones of the plurality of light sources to project light from different ones of the foveal and peripheral projectors.
7. The system as recited in claim 6, wherein the light sources are arrays of edge-emitting laser diodes in a laser array projector component of the light engine.
8. The system as recited in claim 6, wherein the light sources include red, green, and blue light sources.
9. The system as recited in claim 6, wherein the light engine includes a distribution waveguide configured to receive light from the plurality of light sources at a plurality of entrance points and direct the light to a plurality of exit points, wherein the entrance and exit points are implemented as holograms using a holographic film or as surface relief gratings.